Exemption No. 10193

UNITED STATES OF AMERICA
DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
RENTON, WASHINGTON 98057-3356

In the matter of the petition of

The Boeing Company

for an exemption from § 25.1535 of Title 14, Code of Federal Regulations, as specified in Appendix K, § K25.1.4(a)(3)

Regulatory Docket No. FAA-2010-0496

GRANT OF EXEMPTION

By letter BDCO-10-03739, dated September 7, 2010, Mr. Jordan B. Zundell, Lead Project Administrator-Production and Retrofit Projects, The Boeing Company, P.O. Box 3707, MC 67-LR, Seattle, WA 98124-2207, petitioned the Federal Aviation Administration (FAA) for an exemption from the requirements of § 25.1535 of Title 14, Code of Federal Regulations (14 CFR) for its Model 777-200, 777-200LR, 777-300ER, and 777F airplanes, as the regulation applies to low-fuel alerting for approval of these models for extended operations (ETOPS) beyond 180 minutes. This exemption, if granted, would permit the Boeing Company a period of time to develop and incorporate design changes for their low-fuel-alerting system into the Model 777 airplanes.

The petitioner requests relief from the following regulation:

Section 25.1535, as specified in Appendix K, § K25.1.4(a)(3) – Low-fuel alerting.

K25.1.4(a)(3) – An alert must be displayed to the flightcrew when the quantity of fuel available to the engines falls below the level required to fly to the destination. The alert must be given when there is enough fuel remaining to safely complete a diversion. This alert must account for abnormal fuel management or transfer between tanks, and possible loss of fuel. This paragraph does not apply to airplanes with a required flight engineer.

The petitioner supports its request with the following information:

This section quotes the relevant information from the petitioner's request. The complete petition is available at the Department of Transportation's Federal Docket Management System, on the Internet at http://regulations.gov, in Docket No. FAA-2010-0496.

Discussion

Title 14 CFR, Part 25, Appendix K, Section K25.1.4(a)(3) states that, "An alert must be displayed to the flight crew when the quantity of fuel available to the engines falls below the level required to fly to the destination. The alert must be given when there is enough fuel remaining to safely complete a diversion. This alert must account for abnormal fuel management or transfer between tanks, and possible loss of fuel. This paragraph does not apply to airplanes with a required flight engineer."

The above rule ostensibly grew out of the Airbus incident in the Azores where the crew was unaware of a massive fuel leak and had to glide the airplane to the runway.

Boeing and FAA SACO have conducted numerous meetings about how to demonstrate model 777 compliance with the above rule. Boeing believes that appropriate architectural changes to AIMS, with correspondingly revised check list operations, comply with the rule, and Boeing is on record to accede the incorporation of the AIMS changes. It is estimated that the incorporation of these changes will take approximately five years.

These AIMS changes for low fuel alerting will be implemented along with other AIMS changes not related to extended ETOPS, and those other changes will take approximately two to three years to be designed, tested and certified, plus an additional one year for in-service incorporation by airline operators.

These discussions between Boeing and FAA precipitated the decision by FAA to clarify their position via Issue Paper.

While these discussions and negotiations between Boeing and FAA have been proceeding, EASA has granted ETOPS certification for operation beyond 180 minutes. The EASA NPA 2008-01 for extended ETOPS contains a different standard with regards to low fuel alerting than FAA rule K25.1.4(a)(3), and Boeing's current architecture is likely compliant with the EASA CRI without further changes. This puts Boeing FAA certified aircraft at a significant disadvantage in the marketplace.

Granting of the exemption will allow FAA certified aircraft to operate beyond 180/207 minutes, thereby leveling the competitiveness of FAA-certified aircraft to that of EASA-certified aircraft.

Justification

Existing ETOPS Certification Basis

ETOPS certification of current 777 models is based on 777 ETOPS special conditions (25-ANM-84/84A) and ETOPS Policy Letter no. 20-1 (EPL-20-1).

Effect on Safety

During the exemption period, Boeing will make changes to the existing 777 "Low Fuel Alerting" architecture to become fully compliant with K25.1.4(a)(3). While this change activity is proceeding, it is important to take the following factors into consideration:

The current 777 "Low Fuel Alerting" architecture contains a Fuel Imbalance and Fuel Disagree EICAS Advisory message. Both Fuel Disagree and Fuel Imbalance have associated crew-checklist items for leak determination. Also, the FMC provides an alert for Insufficient Fuel. These messages, in addition to the crew fuel-monitoring procedures, listed in AC 120-42B, Section 304, provide significant crew awareness.

Boeing has already made a change to the Fuel Disagree Message as a result of an internal cross model safety assessment based on the A330 Azores incident. Although no deficiencies were noted in the Boeing designs, it was decided to elevate the Fuel Disagree to an EICAS Advisory message from an FMC scratch pad message as a safety enhancement.

The operational approval for 330 minutes will be limited to areas south of the equator, including the Indian Ocean, South Pacific, South Atlantic, and South Pole region where operations are expected to be thin and grow slowly. Therefore, exposure to beyond 180 minutes will be very small compared to the historical database and continuing operations at 180 minutes.

Boeing will study the planned enhancements to comply with K25.1.4(a)(3), in conjunction with existing guidelines and crew procedures, to determine if Boeing can supplement existing guidelines and crew procedures so as to mitigate the impacts due to the enhancements not being available during the exemption period.

In light of the above justifications, Boeing seeks a time-limited exemption from § K25.1.4(a)(3).

Public Interest

This exemption is essential for Boeing's airline customers flying FAA-certified aircraft to compete with airline customers flying EASA-certified aircraft and to

reduce operational costs on longer-range flights. One airline stated that the success of its long-term business plan is dependent on ETOPS beyond 180/207 minutes.

This reduction in operational costs will also benefit the flying public economically and environmentally. The economic benefits are derived from reduced ticket prices and reduced personal travel times due to the more direct flight routes. The reduction in travel times is especially important to the business traveler segment of the flying public.

The environmental benefit is derived from the operator's ability to shorten flight tracks around many regions around the world or natural disasters like volcanic eruptions. The longer flight tracks required for 180-minutes ETOPS result in large increases in fuel burn and/or large reductions in revenue payload. The number of airlines requesting the extended ETOPS certification is significant, which only exacerbates the overall environmental impact. One airline stated that ETOPS beyond 180/207 is an important and significant enabler for the airline to reach its environmental goal to reduce CO_2 emissions. This exemption would represent a significant step toward reducing costs to the operators and thereby its customers, as well as serving to protect the environment from unnecessary fuel consumption.

Request

Boeing hereby petitions for an exemption from 14 CFR K25.1.4(a)(3) as it relates to low fuel alerting on Boeing Model 777-200, 777-200LR, 777-300ER, and 777F airplanes. This exemption is requested to allow Boeing to certify the 777 models for FAA operators wishing to operate ETOPS missions beyond 180/207 minutes per the rules outlined in Appendix K of Title 14 CFR Part 25.

Boeing Response to FAA Letter dated June 10, 2010.

FAA Question 1:

What specific design changes will you be making to comply with section K25.1.4(a)(3)?

Boeing reply:

Boeing will answer this question in response to Issue Paper EE-1.

Supplemental Boeing reply:

Boeing transmitted a description of the specific changes it will make to the Model 777 design to comply with § K25.1.4(a)(3) in letter number BDCO-10-04796 dated November 12, 2010. These changes are identified in the following table.

Current 777 Functionality	Design Changes for Compliance to K25.1.4(a)(3)
Insufficient Fuel Message	
FMC Scratch Pad Message INSUFFICIENT FUEL	Add EICAS Advisory Message INSUFFICIENT FUEL on Active Route. Retain FMC Scratch Pad Message INSUFFICIENT FUEL on Mod Route.
No associated checklist	Add QRH Checklist for INSUFFICIENT FUEL.
None	Add a color change to the Total Fuel Quantity indication on the primary EICAS and the expanded fuel indications synoptic page: Turn "amber" while the message is active.
Fuel Disgree Message	
FUEL DISAGREE EICAS Advisory Message	Revise the trigger threshold for FUEL DISAGREE EICAS Advisory Message to a lower value.
QRH Checklist	No change to QRH Checklist.
FMC fuel predictions use Calculated Fuel as the default. A one-time selection to FQIS Totalizer Fuel is available to the Flight Crew after the FUEL DISAGREE is issued.	Revise FMC logic to allow the Flight Crew to switch between FQIS Totalizer Fuel and Calculated Fuel, at any time, regardless of the status of FUEL DISAGREE message.
A manual fuel entry at engine start inhibits FUEL DISAGREE message.	Remove inhibit of FUEL DISAGREE due to a manual fuel entry before engine start. Add functionality to delete the manual entry total fuel quantity and synchronize the CALC fuel with the FQIS totalizer fuel quantity value, at engine start.
Imbalance Message	No change.
Fuel Qty Low	No change.
	Fuel Flow Eng L,R
None	Add EICAS Advisory Message FUEL FLOW ENG L,R for detection of fuel flow anomalies downstream of the flow meters.
None	Add FUEL FLOW ENG L,R QRH Checklist.
None	Add functionality to automatically display the secondary engine indications when the message FUEL FLOW ENG L,R is active.
None	Add functionality to automatically display the expanded fuel indications when the message FUEL FLOW ENG L,R is active.

FAA Question 2:

How many operators (and airplanes) want to enter such operations immediately after greater-than-180-minutes ETOPS approval is granted? How many of those are U.S. operators?

Boeing reply:

The number of operators, to date, that have expressed interest in entering the 180-minutes-plus ETOPS operations, immediately after approval is granted, is eight. Of those eight, three are U.S. operators. The estimated number of airplanes involved is between thirty and thirty-five.

FAA Question 3:

How many operators would be operating in greater-than-180-minute ETOPS during the exemption period?

FAA Question 4:

How many airplanes would be operating in greater-than-180-minute ETOPS during the exemption period?

Boeing reply:

Our current analysis surmises that the 777 will generate historic growth in the Southern- and mid-Pacific-region routes over the next five years. The extrapolation assumes that the trends seen in the North Atlantic and North Pacific will continue in the Southern Oceans once the 777 is certified for beyond 180/207.

The analysis assumes a total of 780 flights in 2009 ramping up to 6,500 B777 flights in 2015 for the Southern and mid-Pacific oceans. It is assumed that these flights will utilize greater than 180/207 as it becomes available. The estimated fleet size that corresponds to 6,500 flights per year is approximately 70 to 100 airplanes by 2015. That translates into a fleet increase of 62-plus airplanes.

Furthermore, other regions, like the polar region, are expected to need greater-than-180/207 ETOPS capability for increased flexibility, depending on the availability of alternates. It is expected that a U.S. carrier operating in the polar region would utilize 240-minute ETOPS approximately 50 times a year. A separate marketing analysis has projected a fleet size of 13 airplanes for operations that provide increased flexibility with 240-minute ETOPS.

Consideration must also be given to whether the Western and Southern Pacific routes are saturated. Approval of greater-than-180-minute ETOPS and its attendant increased profit potential is certain to attract additional carriers into that market sector.

The above dissertation translates into the following numbers for the 5-year exemption period:

Additional airplanes: 70 - 100
Additional operators: 12 - 15

Boeing is unable to predict at this time how many of those would be U.S. carriers.

FAA Question 5:

What will be the schedule for incorporating the design changes, particularly for the operators who will be operating in greater-than-180-minute ETOPS during an exemption period?

Boeing reply:

Boeing requests a 5-year exemption period based on the following timeline for events:

a) 1 year for Issue Paper EE-l Closure and Firm Design on software change
b) 2-3 years for software development and certification (standard flow)
c) 1 year for operator incorporation after software change is certified

Federal Register publication

Although the petitioner initially requested that action on its petition not be delayed for publication in the *Federal Register*, the FAA found that the petition, if granted, would set a precedent. Therefore, to allow an opportunity for the public to comment on the petition, a summary of it was published in the *Federal Register* on September 23, 2010 (75 FR 184). The FAA received comments from three sources. Comments from V Australia Airline and Air New Zealand fully support Boeing's exemption request. The Air Line Pilots Association, International (ALPA) suggests both a shorter timeframe than that which Boeing requests for complying with low-fuel-messaging regulations, and that "...the petition should be more definite in outlining [Boeing's] plan to ultimately comply with the cited FAR." This commenter feels that five years to implement a software change is unrealistically long and exposes aircraft, passengers, and crews to avoidable risk during that time.

The FAA's analysis

Boeing states in their petition for exemption that appropriate architectural changes to the Airplane Information Management System (AIMS), with correspondingly revised check list operations, would comply with the ETOPS low fuel alert requirement, and that Boeing is on record to accede to the incorporation of the AIMS changes. Boeing provides no explanation in its petition why the company would not be able to comply with this requirement before type certification. This implies that a commitment to making a compliant design change in the future is all the justification necessary to obtain an exemption. To counter this implication, additional context is necessary.

The ETOPS low fuel alert requirement came into existence in amendment 25-120 to part 25, which became effective on February 15, 2007. This requirement was not a part of the previous ETOPS policy or practice that was codified in this amendment to part 25, but came about as a result of service experience that indicated such a requirement was necessary to ensure continued safe long-range operations. At the time the FAA deliberated on this requirement, we and Boeing believed the Model 777 design would comply without further change. It was not until after several engine fuel leaks occurred on the Model 777 in late 2008 and early 2009 that the FAA came to realize that the existing 777 alerting system was not sufficient to confirm the existence of a fuel leak so that the flight crew could take appropriate corrective action. Therefore, it would not comply with the new low fuel alert requirement after all.

In two of these events, the flight crew detected a fuel imbalance and diverted, but did not shut down the leaking engine. In each case, the airplane continued to lose fuel overboard during the diversion and the fuel leak was not confirmed until after the airplane landed safely. By the time Boeing committed to making design changes to the Model 777 airplane to comply with the ETOPS low fuel alert requirement, they were within six months of the time when the company sought type design approval for greater than 180-minute ETOPS. Since the identification of the non-compliance with the low fuel alert requirement came relatively late in the 777 certification program for greater than 180-minute ETOPS and Boeing had committed to making appropriate design changes, the FAA felt that an exemption for an appropriate period of time for Boeing to design and develop a compliant design could be found to be in the public interest.

The FAA has evaluated Boeing's petition for exemption from the low-fuel alert required by 14 CFR § 25.1535, as specified in Appendix K, § K25.1.4(a)(3). We considered whether or not granting such a time-limited exemption would be in the public interest, and if doing so would not adversely affect safety or provide a level of safety at least equal to that provided by the rule from which Boeing seeks exemption. If those two conditions could be met, we also looked into what would be an appropriate period of time for Boeing to design, test, and incorporate design changes into the 777 fleet that will comply with this airworthiness requirement, taking the resulting level of safety into consideration.

ALPA stated that the petition should be more definite in outlining the plan to ultimately comply with the cited regulation. The FAA received more definitive information about Boeing's plan to comply with the low-fuel alert requirement in letter number BDCO-10-04796, dated November 12, 2010. We have placed this letter in the public docket for this exemption petition. While we have not yet found that the specific set of changes to the Model 777 design proposed by Boeing will comply with the rule, we accept that such changes will be a part of a showing of compliance.

Public Interest:

The FAA agrees that a reduction in operational costs associated with being able to operate on more direct airline routes will also benefit the flying public both economically and environmentally. We agree that the economic benefits are derived from reduced ticket prices and reduced personal travel times due to the more direct flight routes. We also agree that the

reduction in travel times is especially important to business travelers for whom time is a valuable commodity.

Boeing points out that more direct flights would also be a significant factor in reaching airline environmental goals for reducing CO_2 emissions. Any benefit of a time-limited exemption on CO_2 emissions would be dependent on the period of time that an airplane could be operated on shorter ETOPS routes before compliant design changes are incorporated. We don't share Boeing's view that this would be a significant benefit because any reduction in CO_2 emissions during cruise compared to flying a longer route for the same city pair, to stay within existing 180-minute ETOPS authority, is small compared to the emissions during takeoff and climb, which would not be affected by an exemption.

Also, these public benefits would be realized eventually after a compliant design is incorporated into the 777 fleet even without an exemption. Therefore, the remaining question then is whether it is in the public interest that these benefits occur now, rather than after Boeing incorporates a compliant design into the 777 fleet at the end of an exemption period. Boeing states that this exemption would be essential for Boeing's airline customers flying FAA-certified aircraft to compete with airline customers flying aircraft that have already received approval from other authorities for ETOPS beyond 180 minutes. We agree that delaying approval of the 777 for ETOPS beyond 180 minutes, while waiting for a compliant low-fuel alert design, could create a real economic disadvantage to those operators of the 777 airplane who are in direct competition with aircraft serving the same city pairs. This could result in those operators choosing to buy those other aircraft to remain competitive.

Boeing mentions in its petition that the European Aviation Safety Agency (EASA) has approved other aircraft for ETOPS beyond 180 minutes based on a different European safety standard than the FAA has adopted. While the FAA has not yet made a specific finding on these aircraft for compliance with § K25.1.4(a)(3), we have reason to believe that they would not comply with the more stringent FAA standard. As such, it would not be in the public interest to create a competitive environment that could result in a larger population of non-compliant airplanes in service than would occur if an exemption were granted. Any non-compliant 777 airplanes that enter greater than 180-minute ETOPS during an exemption period would have to be modified with a compliant design when it becomes available as a condition for the exemption.

Level of Safety During the Exemption Period:

We agree with ALPA that operating passenger aircraft with a non-compliant design would expose passengers and crews to increased risk during the exemption period. We believe that such risk could be mitigated with compensating factors during the exemption period and that the effectiveness of such compensating factors should be in direct proportion with the length of time that they would be in effect. However, this risk is also mitigated by existing features in the 777 design that will be a part of the complete set of flight-deck alerts Boeing will use to comply with the low-fuel alert requirement. So, the additional risk to be mitigated by compensating factors is limited to the specific conditions that the Boeing proposed design changes will address.

Service experience has shown that that the current 777 design and operational procedures have not adequately confirmed the existence of some fuel leaks. Even though the airplane landed safely following each occurrence, the flightcrews did not take specific action to stop the loss of fuel because of a lack of such confirmation. Delays in confirming and taking corrective action for fuel leaks would have a much more significant effect on safety the farther away an airplane is from a place to land. While existing 777 design features provide flight-deck information that a flightcrew could use to discover and take corrective action for fuel loss, diversion times beyond 180 minutes result in less margin for delays in such discovery before the loss of fuel becomes critical.

The design features Boeing is proposing for compliance with the low-fuel alert requirement include several flightcrew alerts with associated operating procedures that are intended to improve flightcrew awareness and identification of the source of fuel loss, or higher-than-planned fuel consumption. The most significant changes to the 777 design and flightcrew operating procedures are intended to detect fuel leaks downstream of the engine-fuel flow meters. Such leaks have been a significant source of fuel loss in service and are currently only detectable with a Flight Management Computer (FMC) INSUFFICIENT FUEL scratch-pad message. It is displayed when the predicted quantity of fuel on board the airplane, upon arrival at the destination, is less than the planned reserves. The current FMC message is not in the flightcrew's normal field of view. Boeing is proposing to raise flightcrew awareness of the INSUFFICIENT FUEL alert by displaying it as an EICAS advisory message. A new alert that will more directly detect fuel leaks downstream of the engine-fuel flow meter will be a FUEL FLOW ENG L,R Engine Indicating and Crew Alerting System (EICAS) advisory message. Boeing did not indicate what logic would trigger this message, only that it would detect anomalies downstream of the flow meters. Other design changes Boeing proposes primarily address improvements in the current FUEL DISAGREE EICAS message. This message is displayed when the fuel quantity indicating system (FQIS)-measured totalizer fuel quantity and the FMC calculated-total-fuel quantity differs by more than a threshold amount. One of these improvements is to reduce the triggering threshold to a lower value so that fuel leaks upstream of the engine-fuel flow meter will be detected earlier in the flight.

The FAA evaluated several options for compensating factors that could be applied until a compliant low-fuel alert design is incorporated into the 777 fleet. These options focused primarily on reducing the risk of fuel leaks downstream of the engine-fuel flow meter, which are not adequately addressed in the current 777 design. Although the proposed changes in the FUEL DISAGREE EICAS message will improve detection of fuel leaks upstream of the engine-fuel flow meters, the current design will detect these types of fuel loss. Also, after fuel in the center fuel tank is consumed, a fuel leak for any cause would result in a main fuel-tank imbalance EICAS message. The flightcrew procedure for this message asks the crew to determine if the imbalance is caused by a fuel leak before opening the fuel-crossfeed valve to balance the tanks. The FAA-evaluated options are:

Option 1: Carry five percent additional fuel reserves above the ETOPS fuel reserves determined under 14 CFR 121.646(b). The additional fuel reserves would allow more time for a flightcrew to detect and take corrective action for fuel loss before it becomes critical. The downside of option

1 is that carrying the additional fuel reserves increases takeoff weight for a given flight, which requires higher engine fuel consumption to carry that weight, and negates some of the economic benefit of being able to operate on the more direct, greater-than-180-minute ETOPS routes between city pairs. Also, carrying additional fuel does not provide a direct means of detecting fuel loss.

Option 2: Require flightcrew recording of engine-fuel flow rate for each engine once every 30 minutes during ETOPS flights, including recording the difference in the engine-fuel flow rate between the two engines. If the recorded difference in engine-fuel flow rate rate between the two engines changes by 500 pounds per hour or more between two recording checkpoints, initiate the fuel-leak checklist procedure. This procedure would provide a direct means of detecting a fuel leak downstream of the engine-fuel flow meter. The 500-pound-per-hour, engine-fuel-flow-rate difference threshold, for going to the fuel-leak checklist procedure, would allow crews to catch most slow fuel leaks before they have a chance to grow into large leaks. A 30-minute recording interval limits the amount of fuel that could be lost before a flightcrew becomes aware of a large leak.

Option 3: Require periodic flightcrew recording of the FQIS-measured totalizer fuel quantity, the calculated total fuel quantity from the flight-management computer, and the difference from the planned-mission fuel quantity at that point in the flight. The existing FUEL DISAGREE EICAS message would detect large differences between totalizer and calculated fuel quantities due to fuel loss upstream of the engine-fuel flow meters, which may occur before such a leak would be detected by periodic fuel-quantity checks. So such a comparison would be useful to detect slower-rate leaks earlier in the flight. For leaks downstream of the engine-fuel flow meter, only the comparison of the measured fuel quantity with planned-mission fuel at that point in the flight would detect such a leak. It is a standard operating procedure, on oceanic flights, for airline flightcrews to monitor total fuel onboard and compare it with planned-mission fuel quantity. We do not see that this option really provides a compensating factor for the design features Boeing proposes for compliance with the ETOPS low-fuel alert requirement unless these checks are done more frequently than current practice. The 2001 Air Transat A330 flightcrew monitored fuel quantity using such a procedure. The only fuel check required by the standard procedure Air Transit used, during the timeframe that resulted in the A330 fuel exhaustion, occurred at a point where the difference between measured and planned total fuel quantity was within 1%. Conducting fuel-quantity checks at the same frequency as recording engine-fuel flow rates in option 2 could identify fuel loss upstream of the engine-fuel flow meters before it becomes critical. In addition, conducting the engine-fuel flow-rate check of option 2, in conjunction with a comparison of totalizer and calculated fuel, would make a comparison of total fuel quantity and planned-mission fuel unnecessary because there could be no difference in these values that would not also be detected by the two other comparisons.

Boeing estimates that between 30 and 35 airplanes would be used in greater-than-180-minute ETOPS initially growing to between 70 and 100 airplanes after five years. Although the FAA does not accept operational procedures alone in lieu of a flight-deck alert for showing compliance with the ETOPS low-fuel alert requirement, the FAA considers that the combination of options 2 and 3 procedures accomplished at 30-minute intervals during the ETOPS portion of each flight

would lower the risk of fuel exhaustion to an acceptable level for this limited number of airplanes during the exemption period.

Exemption Period:

The FAA is concerned, as is ALPA, about the 5 years Boeing states are required to design, test, and incorporate compliant design changes into the 777 fleet. Boeing states, in their response to our request for additional information in support of their petition for exemption, that they need one year to complete firm design of the software change, two to three years for software development and certification using the standard flow times, and one year for incorporation. Boeing's response letter to the FAA was dated June 10, 2010. Six months have elapsed since the date of the letter and Boeing has now proposed specific design changes for showing compliance with the low fuel alert requirement. So, we do not believe it will take a full year from the date of the issuance of an exemption to complete firm design. Since the proposed design changes are necessary to bring the 777 airplane into compliance with the minimum airworthiness standard for ETOPS beyond 180 minutes, we believe that the time to develop and certify the software should be closer to the shorter two-year standard flow time from Boeing's development timeline. Also, after the software is certified, loading it into each airplane should require only a short time and could be accomplished during an overnight stop at an airport where the operator has a maintenance facility. It should not be a major burden for an operator to schedule incorporation of the software change into those airplanes of their fleet used on greater-than-180-minute routes. Therefore, the FAA believes that the entire projected fleet of 70 to 100 airplanes could get the software updates within one month after final certification.

Shortening Boeing's requested exemption period by the six months that have passed since their original design completion estimate, using the shorter two-year span for software development and certification, plus the 11 months we do not believe are necessary for incorporation of the final-design change, results in a reduction in the total flow time by two years and five months; from the five years in Boeing's petition. The Model 777 airplane has been in service for over fifteen years without a fuel exhaustion accident, even in light of the recent in-service history. Boeing and the engine manufacturer have taken corrective actions to address the cause of the fuel leaks in those earlier occurrences and no more fuel leaks have occurred since those actions were taken. The compensating factors identified above will reduce the risk of undetected fuel loss during an exemption period by providing a manual means for performing the functions of the intended design changes. Therefore, rounding up to the nearest whole year, we have determined that a time-limited exemption of three years would allow sufficient time for Boeing to design and implement a compliant low-fuel alert design into the affected 777 ETOPS fleet while maintaining an acceptable low risk of fuel exhaustion.

The FAA's decision

In consideration of the foregoing, I find that a grant of exemption is in the public interest. Therefore, pursuant to the authority contained in 49 U.S.C. 40113 and 44701, delegated to me by the Administrator, Boeing is hereby granted an exemption from 14 CFR 25.1535, as specified in Appendix K, K25.1.4(a)(3), for a low fuel alert. The exemption is granted to the extent necessary

to allow Boeing to design, test, and incorporate design changes into the 777 fleet that will comply with this airworthiness requirement.

This exemption is subject to the following condition(s):

1. At the time of type-design approval of the Model 777 for ETOPS beyond 180-minutes, the Configuration, Maintenance, and Procedures (CMP) document, required by § K25.1.6 of Appendix K to 14 CFR part 25, must contain a configuration item requiring incorporation of a low-fuel alert that complies with § K25.1.4(a)(3) by a date no later than January 11, 2014. If the date of type-design approval occurs after this date, the CMP must require the compliant low-fuel alert design as a condition for ETOPS beyond 180 minutes.

2. The airplane flight manual must contain required flightcrew operating procedures to be in effect during the exemption period for each ETOPS flight on routes that extend beyond 180-minute diversion times, or 207-minute diversion times on North Pacific routes if approved on a case-by-case basis. These procedures must contain the following elements:

    a. Record the following once every 30 minutes during the ETOPS portion of each flight.

        i. Engine-fuel flow rate for each engine

        ii. Totalizer fuel quantity (from FQIS)

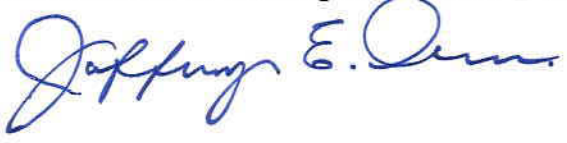
        iii. Calculated fuel quantity (from FMC)

    b. Record the difference in engine-fuel flow rate between the left and right engines at each recording interval. If the recorded difference in engine-fuel flow rate between engines changes by 500 pounds per hour between recording intervals, initiate the fuel-leak checklist procedure.

    c. Compare totalizer and calculated fuel quantities. If totalizer fuel quantity is less than calculated fuel quantity, initiate the fuel-leak checklist procedure.

3. Boeing must develop a comprehensive compliance plan and schedule, supporting full compliance with the low-fuel-alert requirements of 14 CFR 25.1535, as specified in Appendix K, K25.1.4(a)(3), to be presented to the FAA Boeing Aviation Safety Oversight Office (BASOO) by March 31, 2011. Thereafter, Boeing must submit, to the BASOO, a status report every three months identifying all actions completed to date as well as those that remain outstanding. The report must demonstrate Boeing's progressive performance and accomplishments indicating their projected success in meeting both the schedule and conditions of the exemption.

Issued in Renton Washington, on JAN 11 2011



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